CARNIVOROUS PLANT NEWSLETTER

VOLUME 20, NUMBER 4 DECEMBER 19

XC
H101
v.20
#4

CARNIVOROUS PLANT NEWSLETTER

Official Journal of the
International Carnivorous
Plant Society

Volume 20, Number 4
December 1991

Front cover: *Drosera dilatato-petiolaris*. Darwin region.

Rear cover: *Drosera petiolaris* aff. "Kununurra." Species nova from NE of Western Australia. Both photos by and copyrighted by Allen Lowrie. Please see article beginning on page 114.

The co-editors of CPN would like everyone to pay particular attention to the following policies regarding your dues to the ICPS.

All Correspondence regarding dues, address changes and missing issues should be sent to ICPS c/o Fullerton Arboretum, CSUF, Fullerton, CA 92634. DO NOT SEND TO THE CO-EDITORS. Checks for subscription and reprints should be made payable to ICPS.

All material for publication, comments and general correspondence about your plants, field trips or special noteworthy events relating to CP should be directed to one of the co-editors. We are interested in all news related to carnivorous plants and rely on the membership to supply us with this information so that we can share it with others.

Views expressed in this publication are those of the authors, not necessarily the editorial staff.

CO-EDITORS
D.E. Schnell, Rt. 1, Box 145C, Pulaski, VA 24301
J.A. Mazrimas, 329 Helen Way, Livermore, CA 94550
Leo Song, Dept. of Biology, California State University, Fullerton, CA 92634
(Bitnet Address: LEOSONG@CALSTATE)
Seed Bank: Gordon Snelling, 329 1/2 W. Palm Avenue, Monrovia, CA 91016

ACTING BUSINESS MANAGER AND MANAGING EDITOR: Leo C. Song, Jr.

PUBLISHER: The International Carnivorous Plant Society by the Fullerton Arboretum, California State University, Fullerton, CA 92634. Published quarterly with one volume annually. Desktop Publishing: Marilyn Medlin, Public Affairs Office, California State University, Fullerton, Fullerton, CA 92634-9480. Printer: Kandid Litho, 129 Agostino Road, San Gabriel, CA 91776. Dues: $15.00 annually. $20.00 foreign. Reprints available by volume only © 1991 Carnivorous Plant Newsletter. All rights reserved. ISSN 0190-9215. Circulation 749 (216 new, 533 renewal).

LIBRARY

APR 13 1992

NEW YORK
BOTANICAL GARDEN

Editor's Corner

With this issue, CPN completes its second decade. The editors wish to thank everyone for their support and patience. Our new administrative aide, Judith Valona has been handling all inquiries, mailing and orders since June, 1991. She has done a superlative job and has learned fast. Leo has resumed full-time editorial duties. Art North continues his fine job of mail list maintenance. Marilyn Medlin of the CSUF Public Affairs Office continues her fine work in desk top editing. Gordon Snelling continues to handle the Seed Bank. Please note some slight corrections to Gordon's address. Our printer, Kandid Litho, has done a great job in the final production of CPN. To all, thanks for a job well done and now on to 1992!

Enclosed with this issue, you will find a renewal envelope. These are included in all issues since a separate billing mailing would be more costly. If you have already renewed, please use the envelope for any communication with the Society or pass it onto a friend. Also note that the rates remain unchanged from last year, but that since July, 1991, all California members must now include 7.75% sales tax.

Special Notice

SEED BANK LOW ON SEEDS!

Gordon Snelling, Seed Bank Manager, says that CP seeds are in low supply. Please contact him as soon as possible about sending your excess seeds to the Seed Bank. **Reminder**: Gordon Snelling's (Seed Bank) new address: 300 West Carter Drive; Glendora CA 91740-5915; USA. Tel. 818/914-9641.

Correction on Source List for 1991: All payments for orders directed to Acid-Wetland Flora should be made payable to John Hummer.

Want Ads

Tom Kahl (1351 Lake Washington Blvd. S; Seattle WA 98144; USA)
S: *N. fusca, N. alata, N. tobaica, N. reinwardtiana,* & various highland *Nepenthes*. Wait for current update.

J. Hawkeye Rondeau, PhD (37 Sunnyslope Avenue; San Jose CA 95127; USA [Tel. 408/929-6529])
Wants site specific information on the whereabouts of CP (including introductions) in CA, OR, WA, W. Canada, AK. Will purchase ($1.00/page) or swap for equal portions of my DB in CA-OR-WA distributions. Call or write to above address.

Anton M Vukick (444 Round Hill Rd.; Greenwich CT 06831; USA)
W: *N. ampullaria* & other dwarf *Nepenthes*.

Michael Waltz (3241 Columbus Ave. S. #2; Minneapolis MN 55407; USA)
W: N. ampullaria.

News & Views

John D. DeGreef (6, rue Libotte, B-4020 Liege, Belgium) has found what seems to be a very useful insect repellent. It was supposedly from the Entomology Department of the British Museum, and was sent by an E. W. Brisley of Cornwall, England to the journal ASTRONOMY. The formula is :

1 fluid ounce of oil of eucalyptus
1 fluid ounce of oil of citronella
1 drop of pure, liquified carbolic acid

Even though this formula is probably tried and true by tropical entomologists, we must at this time absolve CPN, the co-editors and California State University from any ill effects. If you do try this formula, it is probably wise to try it on a small 1-2 cm area of skin and watch for any reaction before generalized use. Keep out of eyes and mucus membrane areas.

Reading this formula and assembling it in one's mind reminds this co-editor (DES) of the old, original product called "612" which was an oily, clear liquid that smelled heavily of citronella and eucalyptus. I find DEET generally worthless in comparison, as well as the "new improved" 612 spray and lotion. I still have a few precious bottles of the original oily formula and use it very effectively. Apply liberally, do not try to rub it in but let it set on the skin surface as a thin coat of oily liquid.

Susan Kingsley (P.O. Box 222492; Carmel CA 93922) writes:

I spoke with you (JA Mazrimas) briefly at the flower show in San Francisco last month.

I am an artist, and just finished making several pieces based on carnivorous plants (and exotic orchids). My only knowledge of these plants was pictures in books from the library. I had no idea that one could grow them. I am captivated! I have joined the Society, and hope to get started soon.

Enclosed are slides of the "aggressive plant" pieces. They are painted metal wall relief sculptures (copper and silver, air-brushed acrylic lacquer). They are also wearable as broaches. Four of them are currently in an exhibition in Germany, and two of them are at Viewpoint Gallery, at the Crossroads in Carmel.

"Serpentine Sign: Deathly Dream." "Aggressive plant" piece measures 8.5 x 4 x 2.25 inches. Photo by Lee Hocker. © 1991.

Randy Lamb (P.O. Box 6112; Whitehorse; Yukon; Canada Y1A 5L7)

Just a quick note to my fellow CP'ers that I've made a move north to the address listed and I will be there for at least a year or two. My previous listing on Pender Street in Burnaby can still be used since it will remain my permanent contact address.

I'm interested in hearing from other CP growers who live in equally northern latitudes [so how about it Alaska?]. Also, if anyone is passing through my way this upcoming summer of 1992, check with me first and I'll let you know where the CP can be seen in this neck of the woods.

Adam Lifton-Schwerner, Foreman of Gardeners (The New York Botanical Garden; The Bronx NY 10458-5126) writes:

I'm writing to you at the address listed in the March, 1974 CPN.

I am now in charge of a small, but growing collection of carnivorous plants on display at the Enid A. Haupt Conservatory at The New York Botanical Garden and would love to create some ties between us and CP enthusiasts. Also, we need plants. We need to increase our collection.

Our carnivorous plants case is a very vital aspect of our public displays and should show the variety of this group of plants to the thousands who view the plants annually.

I look forward to hearing from you. Thanks.

Carl Mazur (101 Main Street E; Grimsby, Ontario; L3M 1N6; Canada) writes:

I would like to share some cultural experiences that I have had over 12 years of being a CP grower. First of all, regarding hardiness of southern *Sarracenia*. About 8 years ago, I planted some *flava* and *minor* plants as well as *Dionaea* in an outdoor bog with my native CP. Here on the south coast of Lake Ontario, we have one of the mildest climates in Canada. First frost is mid-October to early November; last frost, mid to late April. Our summer day time temps range 25°C-33°C and occasionally as high as 39°C, and very humid. Summer nights range from 16°C-22°C. Our Winter day time temps range -10°C to 5°C with nights -18°C to -5°C; however, infrequently dipping as low as -26°C. Anyhow, my flavas continue to flower every spring with my native *purpurea*. In fact, I have a hybrid of the two that I am considering submitting as a cultivar. The *minor* survived for 3 years as did the *Dionaea*. They probably would be here today; but, as always, I had to experiment. That year I didn't cover the bog with anything more than what mother nature provided. In January, we had a very freak thaw followed that night by a quick freeze. Temperatures fell from a record setting +10°C that day to -20°C that night. Surprisingly, my flavas came through it just fine, the others however, were history. Quite by accident I have also had *flava*, *leucophylla*, and *minor* pots freeze solid overnight with no adverse effects

In my greenhouse, late July-early August, day temps go up to 38°C to 42°C regularly (not good, I need a bigger fan). During that time my plants go into a pseudo dormancy, especially my *Sarracenia*. Their growth slows right down to almost a stand still. My flavas go as far as producing leaves half way between pitchers and phylodia. My leucophyllas put out winter leaves and stop growing. When the high temperatures subside, good vigorous growth returns.

If there are any other CP growers in southern Ontario, I'd love to hear from you. I can be contacted at 416/945-3412 or at the above address.

CP Without A Greenhouse

By Gordon Snelling, 300 W. Carter Drive
Glendora CA 91746 USA

The common concept of insectivorous plants is of delicate organisms that must be grown in a hot, humid greenhouse environment.

When I first started with CP's, I also felt this was the case, however as my collection was rapidly out-growing my limited amount of enclosed space, and my limited budget would not stand the expense of building a greenhouse, I decided that the plants would have to grow on MY terms.

So, now that this understanding had been reached I began to set my plants up outdoors, exposed to all that Mother Nature had to offer. For some people living in an area that is already well stocked with native CP's, this concept is not too strange. However I live in an area that although not totally devoid of life, is altogether devoid of native CP. NO, I don't live in the Sahara, although I do technically live in a desert.

Many people don't realize it but the Los Angeles basin without water would quickly revert to a chaparral community desert. This is where I have been growing CP for the last five years. Our local climate is classified as Mediterranean: this climate condition is characterized by warm days and cooler, moister nights influenced by an onshore breeze. Winters tend to be mild but somewhat variable. The days can get up into the mid 80's(°F), nights commonly in the 30's to 40's. Frosts are quite rare, but when they occur they can be pretty nasty. Recently, when we had a two week period with lows into the 20's, my outside pots were frozen the entire time. Summer temperatures commonly hit the 100°F mark and if we are having Santa Ana winds, my humidity may get down into the teens.

In view of these temperature extremes not all CP's will be suitable for culture outdoors, but with lots of trial and some error, I've found that most species will do well under my conditions.

I have most of my plants on a patio on the north side of my house. This lets me provide a more diverse growing environment as I can grow some plants in the sun and others in the shade.

The most important thing to realize when growing outdoors is that your H_2O consumption will be higher than green house growing. I water my plants using the tray method. Each morning I have to make sure there is enough water in the trays to last the day this is especially important during the summer. The amount of water each tray gets depends on how much sun each tray gets throughout the day. On the average, I have found that 1/4 to 1/2 an inch of water will assure that the plants have enough water to get through the day. During the winter my water usage is less, but it's still vital to check each day, unless of course we are in an all too rare rainy period.

As already mentioned, my growing area is divided into a shade and sun area. I make no attempt to shade the sun section, but there is a tree which provides same shade until about noon, but from then until about 5 pm the area is in full sun. I have found that as long as there is plenty of water in the trays my plants will do quite well in temperatures up to about 110°F(43°C-ed.). Above this I have seen some damage occur. The north wall of my house provides an area of all day shading. It is along this wall that I place all those species that will not tolerate the full sun. Growing here will be found *Darlingtonia*, all tuberous *Drosera*, all terrestrial *Utricularia* species, *Pinguicula*, and *Nepenthes*.

To my mind the benefits of growing my plants outdoors are great. First, and most important to one with a limited budget, the light is free. No buying light fixtures and trying to figure out where you are going to hang them. Second, the plants are able to

feed themselves, in fact they do it so well that I have to plug the pitchers of my Sarracenias to prevent them from getting dead spots caused by an over-abundance of prey. Third, the plants develop better color, flower more and generally set more seed.

There are of course same problems associated with growing outdoors. I've already mentioned increased water consumption, but the rental or purchase of an R.O. unit will greatly reduce the cost.

The other potentially serious problem is contact with insect pests. I will occasionally get attacks of aphids or mealy bugs, but a light spray with a dilute Diazinon® solution will generally clear the problem right up. This treatment must be used carefully since not all plants will tolerate the dose of chemicals. An ideal alternate solution is the use of biological controls. The best predator I found is the larvae of the green lacewing. The eggs may be purchased from most large nurseries or seed mail order companies. Upon hatching,the larvae set out to devour every small insect they can find. They will clear up an aphid infestation in no time flat. The other pest I frequently encounter is moth larvae. These usually stay hidden by day, but by night they appear like magic to consume your most prized specimens. Fortunately they are easily controlled with any one of a number of preparations containing *Bacillus thurgiensis*, a bacteria that will quickly kill the caterpillar without harming the plant.

During suitable times of the year, such as once nights stay above 50°F/10°C, I place all my *Nepenthes* and tropical *Utricularia* outdoors. They stay out until fall and then I move the Utrics. and lowland *Nepenthes* back in. The highland species stay out year round since they like the cool winter temperatures better. In addition to moving the above species, I move any other plants likely to be damaged if a very heavy or frost of long duration is predicted. I nightly bring the trays in and return them outdoors each morning.

After growing CP's out doors for several years, I have found very little difference between my plants and greenhouse plants, except my plants are more tolerant over a wider range of growing conditions. While on the subject of greenhouse plants, keep in mind that greenhouse plants should never be placed outdoors without a suitable period of hardening off. If not given this time to adapt you may lose your plants.

One of these days I hope to be able to set up a greenhouse, although when I do I am sure I will have more trouble adapting than my plants do. But for now I think I will just sit back and enjoy my plants.

A Weekend At The Bruce Peninsula

By Richard Shomin, 983 Barney
Flint, MI 48503 USA

The Bruce Peninsula is that long Peninsula of the Canadian Province of Ontario that lies between Lake Huron and the Georgian Bay. This area offers different outdoor activities for all kinds of outdoorsmen, and one of these of course is botany. The primary CP habitat here is the alkaline marl fen.

Gary Thieme and I were bogging this area for a weekend and found two locations of *Pinguicula vulgaris* and three locations of *Drosera linearis*. None of these locations were mentioned in a Brochure by the Federation of Ontario Naturalists that monitors two other locations. In one fen we found four species of CP growing together on a marl flat-P. *vulgaris*, D. rotundifolia, *D. linearis*, *S. purpurea*. Unfortunately, it would not have made a good photograph. One fen had a colony of hundreds of *P. vulgaris* plants, along with a neighboring colony of D. linearis.

The Bruce Peninsula is also known for orchids of which some grow in fens. We found the striking ramshead orchid growing in the moss of a cedar hummock of a large open fen. Unfortunately we were about a week early for full bloom. The yellow lady slipper is common on the peninsula and can be spotted easily from the road. Grass pink and rose pogonia also grow in fens.

The Canadian Government is in the process of preserving this natural area by buying up private land of the northern third of the peninsula for what is to be called the Bruce Peninsula National Park.

Related References

CPN 9:16-18,1980
CPN 11:19-20 & 27,1982

General References

Schnell D. E. 1976 Carnivorous Plants of the United States and Canada. John F. Blair Publisher, Winston-Salem, NC.
Johnson, Charles W. 1985 Bogs of the Northeast. University Press of New England

Photos by author.

P. vulgaris and *S. purpurea* on marl flat.

3 species of CP at base of hummock—*S. purpurea* seedling, *P. vulgaris*, *D. linearis*.

Author examining hummock on a watery marl flat. Photo by Gary Thieme.

Rocky shoreline habitat of *P. vulgaris* near Tobermory, Ontario, Canada.

P. vulgaris with numerous small insects near Tobermory, Ontario.

P. vulgaris massing in the cracks of a slab of limestone near Tobermory, Ontario.

What Is the Identity Of the West Gulf Coast Pitcher Plant, *Sarracenia alata* Wood?

By Philip M. Sheridan, Rt. 2 Box 2120
Woodford, VA 22580 USA

Abstract

The distribution, variation and habitats of *Sarracenia alata* Wood in the West Gulf Coastal Plain are discussed. The relationships and possible origin of this species are also discussed.

Introduction

Visits to *Sarracenia alata* Wood sites in Mississippi and Alabama from 1984-1987, and growing this species since 1974, convinced me of the need to examine its range in Texas and western Louisiana for its full variation. This investigation was necessary since there is very little published information on S. *alata* in the western part of its range (MacRoberts and MacRoberts, 1988). It has been an overlooked pitcher plant for scientific study and its exact placement in *Sarracenia* phylogeny is not understood.

While botanizing in May of 1987 near Wewahitchka in western Florida with fellow naturalists Bill Scholl and John Hummer, I had the good fortune to meet two botanists from Texas, Edwin Bridges and Steve Orzell (Figure 1). Messrs. Bridges and Orzell were studying wetlands in the West Gulf Coastal Plain and knew of many western S. *alata* sites in Texas and western Louisiana. This encounter resulted in an invitation to join them on a field survey of these westernmost bogs from June 7-12,1988.

Additional visits to Texas and western Louisiana were made from June 19-20, 1989 with Mr. John Hummer. Twenty-two sites in nine counties and five parishes were investigated from 1988-1989 out of a total of approximately 85 extant stations for S. *alata* in the West Gulf Coastal Plain (Bridges and Orzell, pers. comm. 1989). Unreported information about the western stations were discovered on these trips.

Figure 1. Left to right. Phil Sheridan, Bill Scholl, John Hummer, Edwin Bridges and Steve Orzell, in the historic meeting at Sandy Creek near Wewahitchka, Florida, May 12, 1987.

Distribution

Texas accounts for sixteen of the thirty-six county records in four states for S. *alata*. This species has also been found in seven Louisiana parishes, ten Mississippi and three Alabama counties. With a total of twenty counties and parishes (more than half the range) in Texas and western Louisiana, it is truly the West Gulf Coast Pitcher Plant.

The range of S. *alata* is bicentric with a gap of one hundred and forty miles in central Louisiana (Figure 2). Unsuitable soils and alluvial swamp do not allow its survival and colonization in central Louisiana which also does not have any seepage bog or wetland savannah habitats. The range is limited in the east by the Alabama/ Tombigbee Rivers (with the exception of Baldwin County, Alabama), on the south by the Gulf of Mexico, and by lower annual rainfall to the west. The northern range for *S. alata* appears to be limited by the lack of suitable habitat, such as pine savannas and acid hillside seepage bogs, and competition from other plants.

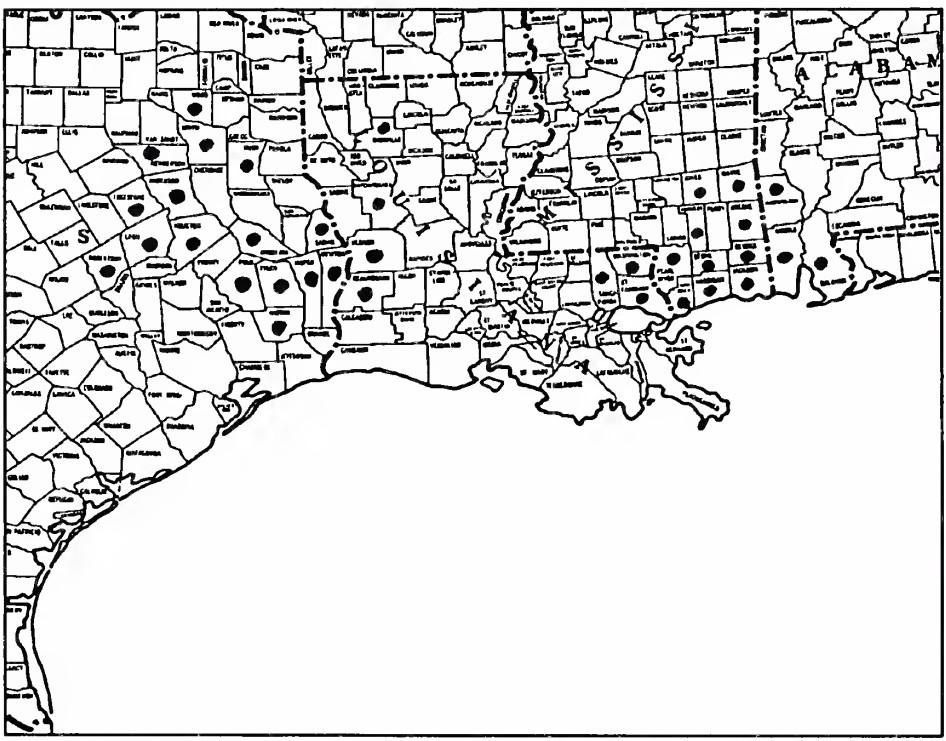


Figure 2. Distribution of *S. Alata*

Some older records for S. *alata* in the West Gulf Coastal Plain are questionable. Calcasieu Parish in Louisiana included present-day Beauregard Parish in the 1800s and it is likely that an old collection there was actually made in Beauregard Parish. Collections from San Augustine County, Texas may be mislabeled since their location data leads to sites in Angelina and Jasper counties, Texas. No extant natural populations are known from Hardin, Rush, Smith, Houston or San Augustine counties in Texas. It is also very rare in Bienville Parish, Louisiana and Sabine and Robertson counties, Texas, known only from one station per county. It is also very rare in Wood County, Texas with only two sites (Bridges and Orzell, pers. comm. 1989) and is locally abundant in Angelina, Jasper and Newton Counties, Texas and Vernon and Beauregard Parishes, Louisiana.

Variation and Habitat

Sarracenia alata bogs in the western-part of the range are remarkable because they are located in a region with no native pine species. Most notably absent is longleaf pine, *Pinus palustris*. Annual rainfall is insufficient to support pine trees, but allows a variety of oaks such as *Quercus stellata* Wang., *Q. incana* Bartram and *Q. marilandica* Muenchh. to flourish. The most western bogs, especially in Wood, Robertson and Leon counties, are kept at constant moisture levels by spring water and have been classified as deep seepage bogs (Bridges and Orzell, 1989). In contrast, many East Gulf Coastal Plain wetland pine savanna habitats receive much of their water from rainfall.

In Robertson, Henderson, Wood and Anderson counties, in east central Texas, pitchers are green to greenish yellow in color with moderate purple veining. The pitchers have noticeable expansion of the upper pitcher tube and arching hoods. Some of the larger specimens measure 30 inches tall with hood measurements of 2 inches in width and 3 inches in length. The Robertson County, Texas site contains several thousand plants, is the only site known in the county, the most western in the species range and less than 100 miles from Austin, Texas! This site, like many S. *alata* bogs in the western part of the range, is being invaded by woody vegetation and needs prescribed burning to restore herbaceous plant vigor.

A site examined in Leon County, in central Texas, contained a number of plants with deep purple pigmentation of the veins, lip and orifice of the pitcher (Figure 3). Some leaves were almost completely reddish-purple. This extreme coloration is attributed to the open habitat and age of the leaves. Fresh leaves, while having heavy pigmentation, were not completely reddish-purple. This heavy pigmentation appears to be an infrequent feature in the western stations of S. *alata*, although commonly found at sites in Mississippi and Alabama. The dominant color form in the most western of the *S. alata* bogs is a green pitcher with moderate purple venation inside the trumpet (Figure 4).

Sarracenia alata is found naturally in wetland longleaf pine savanna at only one site in Beauregard Parish, Louisiana although it has been introduced in this habitat in the Big Thicket National Preserve in Tyler and Hardin counties, Texas (Bridges and Orzell, 1989). Wetland longleaf pine savannas have a seasonally high water table due to low topographic position or an impermeable soil layer. The soil has a silt or clay surface (Bridges and Orzell, 1989). However, it is commonly found in clay-based savannas in southern Mississippi (Norquist, 1984) and southeastern Louisiana (Bridges and Orzell, 1989). The wetland savannah in Beauregard Parish, Louisiana contains plants which are unusual in their undulate hood, shape of the pitcher mouth and the olive or greenish yellow pitcher color with reddish color on the top of the hood. In many respects they are similar to S. *alabamensis ssp. wheryyii*. These differences are noteworthy considering this is the only native site for S. *alata* in wetland longleaf pine savannas of Texas and western Louisiana.

Sarracenia alata is occasionally found in semi-evergreen broadleaf acid seep forests in Texas and western Louisiana. These sites "occupy narrow areas along upper reaches of streams in sandy areas of the Longleaf Pine Savannas Section. This type also occurs, but less frequently, in the counties immediately north of this section," (Bridges and Orzell, 1989). It has a greater dominance and richness of evergreens in the shrub and canopy layers. *Sarracenia alata*, as well as other hillside seepage bog species, are found in few numbers on the fringes of this type of habitat and maybe relics of a time when these forests were maintained in an open state by natural fires. The most northern sites for the species in Bienville and Natchitoches Parish, Louisiana are semi-evergreen broadleaf acid seep forests.

Bienville Parish, Louisiana is two parishes south of Arkansas and represents the most northern limit for pitcher plant bogs in Louisiana. A dense canopy of *Magnolia*

virginiana L., Nyssa sylvatica var biflora (Walter) Sargent, *Acer rubrum L.* and *Liquidambar styraciflua* L., as well as competition from shrubs, allowed limited sunlight to reach the pitcher plants in the one site examined. As a result of insufficient sunlight, the plants were in a depauperate condition. They appeared to be green pitchers with moderate purple veining.

A former semi-evergreen broadleaf acid seep forest examined in Natchitoches Parish, Louisiana which has now been converted to pasture land contains no more than fifteen clumps of S. *alata.* Some of these clumps, however, measured three feet by six feet with individual leaves up to thirty-five inches tall! The flower stalks were noteworthy because of their uniform short length of only nine inches when compared to most pitcher heights of almost three feet. Associates were *Nyssa sylvatica var biflora, Solidago patula* Muhl. ex Willid., *Saururus cernuus L.* and *Rhynchospora rariflora* (Michaux) Ell.

Sarracenia alata occurs in about 68% of the hillside seepage bogs in the West Gulf coastal plain (Bridges and Orzell, 1989). These bogs are usually "found on short, steep slopes (10 to 30 percent), generally near midslope of the headwaters of small ravines but occasionally on lower slopes at headwaters of small streams . . . The substrate is usually a loamy sand or sandy loam, sometimes developing into a sandy peat or shallow mucky peat," (Bridges and Orzell, 1989). The flora is mainly graminoid with wetland forbs and occasional broadleaf evergreen shrubs and lianas. These seepage bogs are "restricted to the Longleaf Pine Savannas Section of the West Gulf Coastal Plain, from Natchitoches Parish, Louisiana, west to Polk County, Texas, in areas of relatively rolling terrain. Individual bogs are generally less than 2 ha. in size, with many less than 0.4 ha. but often several occur within a site. In Louisiana representative examples occur in the Kisatchie National Forest and in western Beauregard Parish. In Texas, bogs occur most frequently in northern Newton and Jasper counties, with the largest concentration of high quality bogs at the Willis/Catahoula Formation contact in the southern part of the Angelina National Forest." (Bridges and Orzell, 1989).

Soil and temperature were analyzed in one hillside seepage bog in Jasper County, Texas on June 19, 1989 resulted in a pH of 5.5., nitrogen and phosphorus at approximately 4% with negligible amounts of potash. Air temperature at midday was 90 degrees F. with a soil temperature two inches underground in full sun of 89 degrees F. Soil temperature in the shade two inches underground was 84 degrees F.

Sarracenia alata found in hillside seepage bogs are golden yellow in color (Figure 5) with widely expanded upper pitchers. Moderate purple venation is found inside the pitcher. As the pitchers age a tan color may develop on the hood and exterior pitcher. Robust specimens can measure 33 inches tall with hood lengths and widths of 3.5 inches.

Flower color observed on cultivated specimens of S. *alata* from hillside seepage bogs is cream yellow. Flowers seem to have a clean or fresh odor. Eleven of my friends and co-workers were surveyed for their opinion of the odor of the flowers. A flower was placed in a glass jar and exposed to moderate sunlight. Five of these people detected a clean or fresh spring meadow scent. One individual noted the classic domestic cat urine smell noted in Schnell (1978), while others reported odors of turpentine, "Opium" perfume, fruit, mango leaves or a bitter smell! It is interesting to note the variety of odors reported. I could detect a turpentine odor but could equate this with the spring meadow or fresh odor detected by others. I have detected a reduced domestic cat urine odor associated with a fresh scent. Thus the flower odor of S. *alata* would seem to be unique, although possibly possessing similarities to S. *flava.*

The most exciting feature is the presence of areoles or light patches on *S. alata* in hillside seepage bogs. Plants with areoles were found in the counties of Angelina, Newton and Jasper, Texas and in Natchitoches and Beauregard Parishes, Louisiana

Figure 3. Heavily pigmented forms of *S. alata* in Leon County, Texas. June 7, 1988.

Figure 4. Typical form of *S. alata* in the western part of its range. June 7, 1988.

Figure 5. Golden yellow *S. alata* in hillside seepage bog of Newton County, Texas. Note *Asclepias rubra* L., *Calopogon tuberosus* (L) Bsp., *Rudbekia scabrifolia* L.E. Brown and *Eupatorium rotundiolium* L. in flower. June 10, 1988.

Figure 6. Comparison of *S. alata* (Number 339 Jasper County, Texas; Number 340 Beauregard Parish, Louisiana) and *S. alabemensis ssp. alabamensis* (Number 341 Chilton County, Alabama). Specimens deposited at Longwood College, Farmville, Virginia (FARM).

Areoles are commonly known in *S. Ieucophylla, S. psittacina* and *S. minor* and have been noticed by Case and Case (1976) in *S. alabamensis ssp. alabamensis* and in *S. rubra ssp. Jonesii* and *S. rubra ssp. rubra* by Schnell (1977,1990). The Cases (1974) notes that the areoles in *S. alabamensis ssp. alabamensis* are "... the consequence of the extreme tissue expansion characteristic of the summer pitchers. They are not structurally quite the same as in the truly areolate species." Areoles on *S. alata* in Texas and western Louisiana are similar to those in *S. alabamensis ssp. alabamensis,* although not confined to summer leaves but produced on leaves throughout the season. A comparative picture of pressed fall leaves of S. *alata* and S. *alabamensis ssp. alabamensis* from cultivated material demonstrates the similarity of the areoles in both species (Figure 6).

Hybridization often occurs between *S. alata, S. psittacina* and *S. Ieucophylla* in Alabama and MIssissippi where the pitcher plant species ranges overlap. One of the results of this overlap in range is introgressed *S. alata* with areoles. Whether any of these areolate plants are pure genetic forms and not introgressed hybrids must await further analysis. Introgression, however, appears unlikely to be a factor in the presence of areoles in the Texas and western Louisiana range of *S. alata* since McDaniel (1966) noted that particular components found in introgressed *S. alata* were not found in areas where hybridization is improbable. Hybridization between *S. alata* and any other sarracenia is highly improbable in Texas and western Louisiana since no other pitcher plant now naturally grows in these areas. Thus it appears the presence of areoles in Texas and western Louisiana plants is an inherent feature of the species and not the result of recent introgression with areolate species of sarracenia. Ancient introgression between *S. alata* and areolate sarracenia cannot be eliminated as a factor in present-day *S. alata* without chemical, paleobotanical and phytogeographic evidence.

It should be emphasized that the occurrence of areoles in plants of Texas and western Louisiana *S. alata* stations is a feature which may be enhanced by environmental conditions. Burning of an *S. alata* bog in Beauregard Parish in 1989 demonstrated this point. A site for *S. alata* in Beauregard Parish, Louisisna was visited in both June of 1988 and 1989. Although areolate pitchers were sought in 1988, none were seen. Many pitchers were damaged by a *Exyra* larvae infestation which could have obscured the presence of windows. Areoles were observed in great numbers of plants in June 1989 several months after a fire. Apparently the improved growing conditions provided by fire and suppression of *Exyra* larvae aided the production of areoles. It should be noted that this bog in Beauregard Parish, Louisiana possess a large, naturally open area. This area in June of 1988 was not noted to contain any obvious areolate plants but did contain them in 1989. The effect of fire, even on an open area, may have been enough to produce areoles. Conceivably the supression of *Exyra* larvae by fire played a role in reducing insect damage to pitchers and enhancing areole production.

Pipeline hillside seepage bogs in Jasper County, Texas also illustrate environmental conditions enhancing areole production. Areoles were observed in a Jasper County, Texas pipeline hillside seepage bog in both 1988 and 1989. The site is maintained in a very open condition by annual mowings of the pipeline right-of-way. These annual mowings provide open habitat and allow dense stands of *S. alata* to develop. Fire would natrually maintain the hillside seepage bog in an open condition, but in this instance the pipeline has substituted as a disturbance factor. Mechanical clearing by bushhogs simulates the effect of fire by inhibiting the growth of woody plants. The suppression of woody plants allows herbaceous types to flourish. Thus, disturbance of hillside seepage bogs may enhance areole production in *S. alata by* providing open growing conditions.

The occurrence of areoles may be a recent evolutionary phenomenon caused by

natural selection. While filming a trapped bumble bee in a *S. alata* pitcher in a seepage bog in Newton County, Texas in 1988, I noticed that the insect attempted to escape through the **sides** of the trumpet. Apparently the light-blocking hood of the pitcher confused the insect in how to escape through the open pitcher mouth. Light streaming in through the sides of the leaf caused the bumble bee to fly up and down in the pitcher as if the insect were trying to escape through the translucent pitcher walls. After many attempts to escape, the insect finally collapsed in exhauston in the recesses of the pitcher. Areoles could further confuse the insect by allowing more light to enter the pitcher. Conceivably, more insects would then be caught. Continued large prey captures would result in more vigorous plants with more seeds and thus a greater likelihood that areolate *S. alata* will continue to survive, flourish and spread through the process of natural selection.

Relationships within *Sarracenia*

Several authors have noticed a strong resemblance between *S. alata* and the *S. rubra* complex. (Case & Case, 1976; McDaniel, 1966: Schnell 1976, 1978). Other authors (MacFarlane, 1908; Wherry, 1935; Bell, 1949) have aligned *S. alata* with the *S. flava* / *S. oreophila* group. On the *S. flava* / *S. oreophila* group Schnell and Krider (1976) state, "Our impression is that this interpretation of relationship was based on the factors of erect pitcher habitus, similarity in pitcher background color (yellow-green to yellow), yellow petals, a weaker though still striking *flava*-like feline or musty odor, and the tendency for *S. alata* to grow in similar habitat westward from where the *S. flava* range ends." "However," they continue, "while these arguments may be superficially compeling—a careful morphological examination in perspective will confirm the closer relationship of *S. alata* to the *S. rubra* group, since petal shape, lid shape, and degree of reflexion as well as details of the lid column all more closely resemble the *S. rubra* group," (Schnell & Krider, 1976). I completely agree with these observations, and would add that *S. alata* lacks phyllodia, the flowers do not tilt upward as in *S. flava* after anthesis and the sepals recurve when the flower matures. These features separate *S. alata* from the *S. fava* / *S. oreophila* group and place it with *S. rubra.*

The Origin of *S. alata*

McDaniel (1966) suggests that S. *alata* arose as a result of hybridization between *S. rubra* and *S. flava* or their ancestors. This can be supported by the characteristics that *S. alata* possesses from both putative parents. *Sarracenia alata* has the *flava*-like characteristics of yellowish color, large yellow flower, similar flower odor and early flowering time. It also has the *rubra*-like characteristics of absence of phyllodia, petal shape, recurvature of sepals, lid shape, degree of reflexion of the hood and details of the lid column. Furthermore, petal shape and general size seems to be intermediate between the two putative parent species. Especially significant to me is the slight feline odor, recurved sepals and petals of the flowers of *S. alata.* The *S. rubra* complex possesses flowers which are sweet (Schnell, 1978). The fact that the feline flower odor of the *S. flava* / *S. oreophila* group occurs in a pitcher plant with sepals and petals similar to the *S. rubra* complex is highly suggestive of a hybrid origin for *S. alata.*

The hybrid origin of *S. alata* is a fascinating idea yet still needs more scientific data such as statistical analysis of intermediate characteristics, fossilized pollen from area of origin, phytogeographic studies, DNA probe, polymerase chain reaction studies and hybrid experiments to be accepted. If *S. alata* arose as a hybrid between *S. flava* / *S. oreophila* and the *S. rubra* complex one would think the hybrid would occasionally still occur in the wild and that does not seem to be the case. I have yet to see a specimen of such a hybrid in the wild or a herbarium. The hybrid, however, may have, arisen from the ancestors of the present species under environmental conditions favorable to

hybridization, survival and spread of the new species. Hybrid experiments are now underway between the *S. rubra* complex and *S. flava / S.oreophila* by Bill Scholl and I to explore the possible hybrid origin of S. *alata* further and will be reported in a future paper.

Case and Case (1976) state, "Many pitchers of *S. jonesii* cannot be distinguished from similarly sized pitchers of *S. alata* (Wood) Wood. No one seriously considers that *S. jonesii* belongs to that species." Fred Case, in personal conversations, has since expanded on this original quote to the point that S. *alata* may indeed be a large, yellow flowered S. *jonesii*! It is noteworthy that Schnell and Krider (1976) found that *S. alata* was more closely related phenetically to S. *jonesii* than to any other member of the *S. rubra* complex. Case and Case (1976) propose a migration route for *S. jonesii* along the Flint and Coosa Rivers which would have brought it into contact with *S. oreophila* (or its ancestor) in western Georgia and central Alabama. Recently discovered sites in southwest North Carolina also place *S. jonesii* very near to *S. oreophila* (Govus, 1987). Such a contact could have resulted in hybridization and may explain the close phenetic relationship between S. *jonesii* and S. *alata*.

It has also been proposed that *Sarracenia alata* is actually a western *S. alabemensis ssp. alabamensis* that has evolved a larger yellow flower. Areoles, golden yellow color and general structural features of *S. alata* could lend support to a relationship with *S. alabamensis ssp. alabamensis*.

Finally, it is possible that *S. alata* is simply exhibiting convergent evolution with *S. flava / S. oreophila* and the *S. rubra* complex. Natural selection could have resulted in useful features of other pitcher plant species occurring in *S. alata*. The presence of areoles may be an example of such an event actually taking place.

The question remains though, what is the origrin of the West Gulf coast pitcher plant? Is it a western *S. alabamensis ssp. alabamensis*, a large yellow flowered *S.jonesii*, a hybrid between ancestral stock of *S. rubra* and *S. flava / S. oreophila* or a more distantly related species? This question warrants further investigation.

Conclusion

Sarracenia alata is distributed in the West Gulf coastal plain with very local sites at the extremes of the range. The major color form is green to golden yellow with moderate purple veining inside the trumpet. Heavily pigmented forms are infrequent. Flower color is cream/yellow, with the flowers having an odor similar to *S. flava* but are unique in having a spring meadow or fresh scent. It mainly occupies hillside seepage bogs and deep muck seepage bogs but also grows in semi-evergreen acid seep forests and is rarely found in wetland longleaf pine savannas. Areoles are found in *S. alata* growing in hillside seepage bogs. It is closely related to the *S. rubra* complex and may have descended from a hybrid between the *S. flava / S. oreophila* and the *S. rubra* complex or their ancestors.

Note: VHS videotapes are available from the author for $29.95, plus postage, on the above subject.

Acknowledgments

I would especially like to thank Edwin Bridges and Steve Orzell for their invaluable assistance. Additional thanks are due to Dr. Alton Harvill, Don Schnell, John Hummer, Ruth Curlee and Bill Scholl for their comments, ideas and review.

Bibliography

Bell, C.R. 1949 A cytotaxonomic study of the Sarraceniaceae of North America. J. Elisha Mitch. Soc. 65:137-66.

Bridges, Edwin and Orzell, Steve. Personal communication 2/24/89.

Bridges, Edwin and Orzell, Steve. 1989. Longleaf Pine Communities of the West Gulf

Coastal Plain. Natural Areas Journal. 9(4).:246-263.
Case, F.W., and R.B. Case. 1974. *Sarracenia alabamensis*, a newly recognized species from central Alabama. Rhodora. 76:650-665.
—— 1976. The *Sarracenia rubra* complex. Rhodora. 78:270-325.
Govus, Thomas E. 1987. The occurrence of *Sarracenia oreophila* (Kearney) Wherry in the blue ridge province of southwestern North Carolina. Castenea 52:310-311.
McDaniel, S.T. 1966. A taxonomic revision of *Sarracenia* (Sarraceniaceae). Unpubl. PhD Diss., Florida State Univ. (Available from Univ. Microfilms, Ann Arbor, Mich.)
MacFarlane, J.M. 1908. An Engler, Das Pflanzenreich 4:pt. 110.
MacRoberts, B.R. and M.H. MacRoberts. 1988. Floristic composition of two west Louisiana pitcher plant bogs. Phytologia 65:184-190.
Norquist, H.C. 1984. A comparative study of the soils and vegetation of savannas in Mississippi. M.S. Thesis. Mississippi State University, Mississippi State, Miss. llOp.
Schnell, D.E. and Krider, Daniel W. 1976. Cluster Analysis of the Genus *Sarracenia L.* in the Southeastern United States. Castanea 41:165-176.
Schnell, D.E. 1977. Infraspecific variation in *Sarracenia rubra* Walt.: Some observations. Castanea 42:149-170.
Schnell, D.E. 1978. *Sarracenia L.* Petal Extract Chromatography. Castanea 43:107115.
Schnell, D.E. 1978. Systematic Flower Studies of *Sarracenia L.* Castanea 43:211-220.
Schnell, D.E. 1990. Personal communication.
Wherry, E.T. 1935. In Walcott, M.V. Illustrations of North American Pitcher Plants. Smithsonian Institution, Washington, D.C.

Back To Caraça

By Fernando Rivadavia, Rua Inacio Pedroso 230
CEP 05612, São Paulo, SP, BRASIL

It had been only 8 months since I had gone to Caraça, but I was already dying to go back! In fact, I had already attempted to go back a few times with other people I heard were going. Since it didn't work, I decided that if I was to go back soon, I had to organize a trip myself, and not depend on others. I wanted to return as soon as possible and also try and see Caraça during a different season, so the time was January, 1991. Organizing this trip ended up being much more complicated than I expected. Also, I was really busy with exams at the end of the high school senior year and for university applications. But I finally got it all together, including reservations, bus tickets, and people interested in going. A group of 8 people (all of whom had already been to Caraça at least once) left São Paulo city on the night of the 27th, Sunday, on a bus to the city of Belo Horizonte, a 9 hour trip. After waiting for 2 hours in B.Horizonte, we got a bus to a city close to Caraça, (another 2 hours) and then 2 taxis for a 30 minute drive to the Caraça sanctuary, the final step of my sleepless ride. I guess the lack of sleep was in part due to the uncomfortable bus. but mainly because of my excitement (the rest of the group slept like rocks).

After we arrived, I gave my companions 2 hours to arrange their stuff around the room where we were staying (in a small cottage which used to be the slave's quarters and has not gotten any better, but it's cheap!) while I took a short hike nearby to look at some native orchids. I then herded then all out to start our hikes around the Caraça valley (and start my CP hunts!). I knew that summer was the rainy season, but I didn't know what we were in for. It rained 5 out of the 6 days we were there. All the rivers,

streams, lakes, and waterfalls had doubled in volume since I had last gone in May of 1990. Our pairs of old sneakers stayed dry for a very short time. We were always being forced to cross small streams which before were nonexistent, or having to swim in places where we had walked ankle high in water during our previous visit to Caraça. Another surprise was the flies, mosquitoes, and large horse flies which were always buzzing around our faces and other exposed body parts. Luckily, I had taken an insect net which I started wearing over my head when it got unbearable. In the end, though, we all donated lots of our juice to the pests.

Fortunately, CPs were no trouble. I turned every place we went and passed upside-down in search of the little jewels we were all interested in. I had expected to see many of them flowering but most were hidden, with occasional flowers present. I had seen more on my previous trip. I guess most of them prefer to flower during the dry season, even though that is during winter. This rule seems to apply mainly to the CPs found in the valley (between 1200 and 1400 m). I only climbed one of the many surrounding mountains (Mt. Carapuça: 1955 m), but I noticed that most of the CPs of this higher altitude prefer to flower during the summer. I had not seen any of then with flowers when I last climbed that mountain. This must be a result of the colder temperatures near the summit, and I imagine that on other nearby mountains the same probably happens.

I guess I'll talk about the valley plants first, and leave the dessert for later.

I found a few more *D. montana* "pink flower" sites this time. The plants were a deeper red color but much smaller than before. It was hard to find a nice patch to photograph. I found a small number of *D.communis* plants growing next to *D. montana* on a stream bank. The spoon-shaped leaves reached 1.5 cm in length and most were purple-red in color, like *D. montana*. I was not able to locate a *Drosera* species which had been seen by a friend in November growing near a waterfall. I searched all around, but had no luck. This sundew was said to have thin leaves, so it might be *D. graminifolia*. It would be interesting to find this species growing in the valley, since I've only found it on top of Mt.Carapuça (but it would be even better to find a new species!)

I found out that the aquatic Utric I saw on the previous trip, growing in shallow mountain streams, is *U. neottioides*. It must have been dormant this time, since it was not found in the streams where it had been seen. It depends directly on the water levels in streams to flower, so it probably only flowers when they are lowest during winter. The stolons were not found due to their small size and the algae which covered the rocks (and the stolons). The *U. sp.* "yellow flower" with the long, climbing peduncle was not seen either, but I suspect it's only a larger *U. subulata*. Some of the *U. subulata* I collected last year in the same place are producing flower stalks up to 20 cm long. *U. pubescens* turned out to be more common than I expected! It had only been seen in one place by my friend Mauricio in July,1990. I not only saw this *U. pubescens* site, but I found *U. pubescens* growing in 4 other places! It was always found growing along shaded, moss-covered stream banks, sometimes even underwater due to the high water levels. I only found one flower which was a dark, pinkish-purple color. The plants Mauricio collected last year produced light, violet-purple flowers in cultivation. I wonder if there are more color variations in the plants from the other locations? I do not know how I did not see this plant when I last went! Either they were dormant or my eyes just were not very good at locating Utrics. The species we thought was *U. tricolor* turned out to be the same as the *U. sp.* "purple flower" we had found. The difference in leaf size was due to the amount of sunlight received. I found 3 new locations of this unknown species. It also seems to prefer growing in shaded stream banks, sometimes mixed with U. *pubescens*,. I did find 3 places in which it was growing with no covering from other plants and lots of flowers were present. One place was on a little moss island on rocks in the middle of a waterfall down in the valley. Another was halfway up Mt. Carapuça where it was growing in pure sphagnum. The last was

on top of the mountain, growing in sandy soil and sphagnum near *D. graminifolia*. It bears various purplish-blue flowers up to 1.2 cm long and 8 mm wide on peduncles up to 15 cm long. The other *U. sp.* I talked about in the previous Caraça article (the one with leaves like *U. subulata* but growing in a shadier area with drier soil) turned out to be another one of the many variations of *U. subulata* found at Caraça. By the way, *U. subulata* continued to be found all over. I found lots more places where it grows, many in humid areas far from streams. I even found the yellow weed on the mountain top together with *D. graminifolia* ! Most flowers seen were cleistogamous, while only a minority were normal.

I found 2 new species of *Utricularia* on this trip. One was found growing in almost pure sand with a thin layer of peat on top. The sloping ground in which it grew was constantly wet because of a nearby rocky mountain side which was always dripping with water. I had already observed this last year, but had not been able to find any CP there. I only found this *U. sp.* because of one, whitish-yellow flower I saw hidden between grasses when I stopped to wait for the rest of the group to catch up. The leaves are thin like those of *U. praelonga*, up to 10 cm long and 2 mm wide. I found a couple of flower stalks up to 20 cm tall. All had between 2 and 4 ripe seed pods (except for the one with the flower which was a little behind schedule). This Utric has already been found by Mauricio growing near the city of S. Paulo. The other new species I found has leaves up to 2 cm long and around 1 mm wide. The flower stalks reach a length of 7 cm and each possesses a single flower around 8 mm high and wide. The flowers are different shades of a light purple-violet and shaped like those of *U. dichotoma*. It was found growing in 3 locations, all on Mt. Carapuça. One was at the base of the mountain, in a mossy stream bank close to a waterfall. Another was halfway up the mountain on the sides of a shaded, moss-covered stream. It was then found near the summit growing in sandy soil together with *D. graminifolia*.

The species I said was probably *U. nephrophylla* is really *U. reniformis*. There seems to be quite a mixup between these 2 species. I've seen 2 books which show photos of *U. reniformis*, but they call it *U. nephrophylla*. The true *U. nephrophylla* has leaves up to 2 cm in length and 1 cm wide and has small, white flowers while *U. reniformis* has flowers which are blue-violet and its leaves may be up to 14 cm wide and 65 cm long! *U. nephrophylla* is mainly restricted to the state of Rio de Janeiro, while *U. reniformis* has a much wider range in Brasil. Of the three *U. reniformis* sites we knew of at Caraça, two were in the valley and one on the Carapuça mountain. The smallest plants I found in one of the lowland locations turned out to be U. *pubescens* which had also been found on the same streambank. We only noticed this when they started flowering in cultivation in late 1990. They have the same flowers but the leaves are still different. The one we initially thought to be *U. reniformis* still produces only small, kidney-shaped leaves even though it is growing in the same conditions as the *U. pubescens* collected at the same site. Anyway, I found more *U. reniformis* at the other valley location near the waterfall. They were plentiful on the opposite side of the stream from where I had seen them on the previous trip. At the shaded base of the waterfall, getting a constant cloud of spray, the ground plus the lower branches and trunks of bushes were carpeted with moss and small leaves of *U. reniformis* . They were even smaller this time with leaves only around 1 cm wide.

But as I said before, the mountain top reserved the best surprises of the trip. This time, I spent 3 hours calmly exploring the summit and discovered that *U. reniformis* is more than common up there. The constant moisture from the clouds and the many water springs allow sphagnum to thrive in abundance. *U. reniformis* seems to prefer growing in these sphagnum mounds, both in full sunlight and in the shade of taller plants. The leaves were larger than they had been in the winter with petioles around 15 cm long and lamina around 6 cm wide. Few flower stalks were found. The shortest one was 60 cm long and the longest reached 1 meter in length! The length of the leaves

and peduncles depended on the amount of sunlight in the place where they were growing. The more sunlight, the shorter the leaves and flower stalks (and vice-versa). Each flower was around 5 cm long and 4 cm wide and their colors also depended on sunlight. Then in the shade, they were a light purple-blue with 2 light-yellow vertical marks. When in the sun, they were a darker pinkish-purple with brighter yellow streaks surrounded by a bold pink-purple ring.

Not only were U. *reniformis* flowering on top of the mountain, but *D. graminifolia* was too! Almost every plant had a peduncle up to 35 cm in length, and they were only halfway through flowering!. Each flower stalk had up to 2 light-pink flowers up to 2 cm in diameter. Some branching stalks had 4, 5, or 6 flowers opened at the same time! I noticed that the flowers open independently of sunlight. Then I reached the top of the mountain at 10 AM. It was really foggy but the flowers were all open. Later on it cleared up and we could see a beautiful view of Caraça and other surrounding areas. I guess if D. *graminifolia* 's flowers did not open on cloudy days, the species would die out since that summit is constantly covered with clouds, especially now during the rainy season when it is flowering. Since I was exploring with more calm and did not have the "keep moving" pressure of a large group, I found out something unfortunate which I had not seen last time. *D. graminifolia* is not as plentiful as I had imagined. Where I thought there were lots of plants growing in sandy soil on the terrace like area, I now saw that the plants are only found on the sides of the trail through the thick vegetation and do not extend any farther into it. Since the trail was man-made, I guess *D. graminifolia* previously grew only in the sphagnum areas. But the species is safe from man on the rock walls, where most grow far from reach. Fortunately, I discovered another rock wall with sphagnum and *D. graminifolia* which is inaccessible (I could only see it from a distance of 30 meters) and safe from overcollecting. Another good thing was that one of the priests at the Caraça sanctuary told me he has seen D. *graminifolia* growing on top of another one of the peaks of the Caraça mountains.

The mountain had one more surprise for us. The most important discovery of the trip was made near the summit on one of the various rock walls dripping constantly with water, where I had already found *D. graminifolia* and *U. reniformis* growing with sphagnum and other mosses. On my way up, close to the top, I came upon the first of the falls and saw some small, purple-violet flowers with a yellow center surrounded by a darker violet-purple ring. I immediately thought it was a new *Utricularia*, but when I pulled a plant out, I saw its roots and noticed it was a *Genlisea*! Both Mauricio and I had passed by this place last year, but had not seen this species which is most likely *G. violacea*. Either it was dormant or we were just too excited looking at *D. graminifolia* and didn't notice the small leaves. It was very common in this small area, but unfortunately I did not find it in any of the other similar walls. The leaves are around 1 cm long and club-shaped. The flower stalks were up to 10 cm in length and each carried 1 or 2 flowers around 1 cm long and wide. I noticed that this species propagates naturally by its traps. I saw a couple of roots with leaves growing from them. Mauricio had already noticed this happening with the *Genlisea* he had found last year in the valley. They both seem to be the same species, the only difference being that the ones I found have flowers which are a bit darker in color. I am now trying to reproduce the plants I collected by taking leaves, traps, plus flower stalks and placing them in live sphagnum.

We left Caraça on Saturday afternoon, the 2nd of February, and arrived in S.Paulo early Sunday morning. We were all exhausted from the long walks and mountain climbing at Caraça mostly because of my "CP fever" which turned the trip into a marathon to see as many places as possible during our 6 days there. But we were all willing to go back and do it all over again right away, if we could. I hope to go back another time before the end of 1991 and explore the other mountain tops at Caraça, where most of the CP "jackpots" seem to be.

A Field Trip to Darwin and Kununurra for C.P.

By Allen Lowrie, 6 Glenn Place, Duncraig, 6023,
Western Australia, Australia

On the 6th of April 1990 I boarded the plane in Perth for the flight to Darwin. Darwin is the capital of the Northern Territory and is situated on the coast at the extreme tip of middle Australia. The weather patterns here are roughly 6 months of dry and 6 months of wet season. The daytime temperatures in the wet and towards the end of the wet when I arrived were, daytime 33°C, night time around 27°C. For the 11 days I spent in this region it only rained twice and then for only a short period.

In 1988 at the same time of the year, I was in this region. I travelled up from Perth in my Land Cruiser with the family. This 1990 trip I knew where I wanted to go and this time I was not being asked to get a move on by the three women in my life. I intended to take my time and have a damn good poke around the bush.

In the first 4 days I checked out three areas I knew about from my 1988 trip. The Howard Springs area, Palmerston and Noonamah. Below is an account of what I found growing in those areas.

Howard Springs

In an area near the Howard River I botanised what I call a meadow. The soil was sandy, low lying ground which was mainly very wet with slightly drier areas scattered here and there. The vegetation was open herb field with a few trees scattered throughout the area.

In the slightly wet areas *D. dilatato-petiolaris* was common, these plants were in flower. The scapes of this species are very tall, up to 60 cm in most cases. I could see from the fruit that they had been flowering for at least two months. Millions of seedlings were also present over most of the ground. *D. dilatato-petiolaris* is a basal rosetted plant with the new leaves semi-erect within the rosette. The older leaves are almost flat to the soil surface. The petioles are fairly broad up to 5 mm wide and the lamina remains dewy even when the leaf has almost moved to the ground level position. This species forms compact clumps up to 40 cm in diameter in some cases on very old plants. The clumps are formed by the parent plant producing plantlets at the base.

In the very wet areas *D. petiolaris* was common. The entire plant here was very dark red where as *D. dilatato-petiolaris* had green petioles and red laminae. The petioles of *D. petiolaris* are very thin, no more than 2 mm wide and up to 8 cm long in most cases. The leaves are arranged in an erect and semi-erect stance. *D. petiolaris* was not in flower and no evidence was present to show that it had been in flower early in the wet. This is a small mystery I intend to clear up shortly.

Amongst the *D. petiolaris* and *D. dilatato-petiolaris* a number of *Utricularia* were discovered. These were pressed and pickled on the spot in F.A.A. solution as well as photographed. Notes were taken of all the specimens and were recorded in my field book. Later in Perth I keyed out these specimens using my stereo microscope and Peter Taylor's wonderfully easy to use book, "The Genus *Utricularia* A Taxonomic Monograph".

The first *Utricularia* I found was *U. lasiocaulis*. This species had pale mauve flowers about 1 cm across born on scapes 8 cm long. At the base, leaves were present with fairly large bladder traps. This species is easy to identify by the number of hairlike projections covering the entire scape.

As I looked closer, crouching down near the ground I discovered a few more *Utricularia*. Once I got my CP-eyes tuned in to the miniature forest before me, I was

picking out the *Utricularia* easily amongst the numerous herbs that surrounded them. I found *U. minutissima* next. This species was no more than 1.5 cm in height with a very small dark pink flower around 3 mm wide. Leaves and traps were present as I was to find on all the *Utricularia* I came across.

Early authors report that leaves are not present on some *Utricularia* when they are in flower. I never failed to find leaves and traps on every specimen I collected. Personally I feel this misconception has come about by botanical collectors simply pulling the *Utricularia* out of the ground and not taking care to collect the basal portions of the plant. I might add that most of the *Utricularia* in herbariums in Australia have many specimens in this condition, that is Utricularia without leaves or traps.

Other *Utricularia* found at this location were:

U. limosa—small plants to 5 cm tall with one or more small snow-white bilobed lower lips. Each flower was about 8 mm wide.

U. chrysantha—plants up to 20 cm tall with a number of beautiful dusky-yellow flowers about 1 cm wide with the backs of the corolla dark-pink. This species also grew in dryer soils on slightly higher ground than the main meadow area.

U. odorata—plants up to 20 cm tall displaying bright yellow flowers up to 1.5 cm wide with long bright yellow nectary spurs. These plants favoured the very wet areas.

U. hamiltonii—plants up to 8 cm tall with single flowers to each scape. The corolla colour is violet with distinctive purple markings near the yellowish palate.

U. capillaris-extremely fine plants with a mosquito-like single flower on a thread-like scape up to 6 cm in height. The entire flower is golden-brown and damn hard to find unless you lay prostrate on the ground. The mosquito-like flower has a 5-lobed lower lip about 3 mm wide and two very long very fine thread-like appendages on the upper lip about 2 cm long. When I discovered this species I wondered how an insect would find *U. capillaris* to pollinate the flower. This plant was impossible to see amongst the other nearby herbs when the sun was overhead.

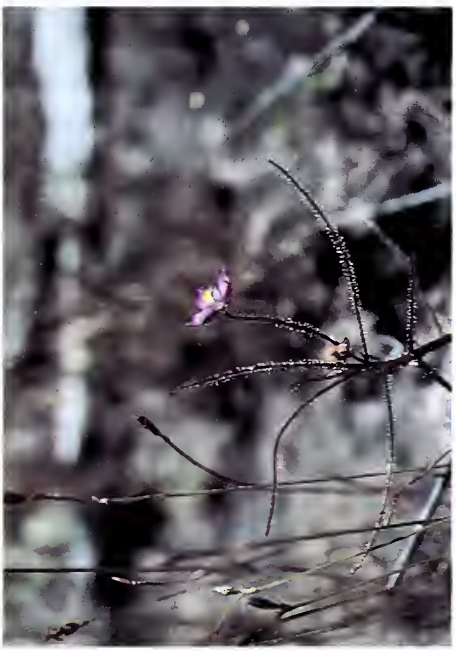
I finally got the answer to this mystery at another location later in the trip. As the sun is rising or in this case setting, the glow of the later afternoon sun just before sun lights the corolla of *U. capillaris* to the point where the entire corolla radiates its own golden light. The scape doesn't pick up the light and the overall appearance is that of a glowing mosquito in mid-air. At this time of the day the flowers of this species were extremely visible at standing height. I might add it was quite a picture. All the other herbs were quite black compared to this little species glowing like mad and moving about just like a hovering mosquito does in the gentle breeze. I thought at the time what a wonderful adaptation evolution has provided for this species. A plant that can imitate a flying, hovering insect and can advertise its position by glowing gold-like when all the other surrounding plants are quite black. As well as produce this adaptation to perfection at sunset at the perfect time of the day when all mosquitos are active.

Amongst the *Utricularia* I found a new taxa of *Byblis*. *Byblis liniflora* aff. "Darwin." I had found this species in 1988 but I didn't know how common it was to be in the general Darwin region until this trip. This species grows up to 125 cm in height and has short leaves about 3 cm long at best. The plant is maroon with a little dark green and only has one flower open at any one time. The flowers are about 1 cm in diameter and blue-purple in colour on the inner and outer surfaces. This species is always found in wet soil conditions.

At other locations within 30 km of the Howard River location, I also found the typical *Byblis liniflora* growing near *Byblis liniflora* aff. "Darwin." These typical *B. liniflora* plants were pale green in colour, more bush-like with leaves up to 5 cm long. Each plant displayed a number of open flowers at one time and the plants were always found on higher drier ground. At all of these locations I saw no intermediate forms

Drosera falconeri X *Drosera petiolaris* aff. "mini rosette". A natural hybrid from the Darwin region.

Byblis liniflora. This plant appears to be the TYPE. Plant in the early stages of growth.



Byblis liniflora aff. "Darwin". Species or subspecies nova from the Howard Springs area.

Byblis liniflora aff. "Kununurra". Species or subspecies nova from the N.E. of Western Australia.

between the two species. They were both maintaining their own forms even when they were found only metres away from each other. This evidence alone proves we were dealing with two individual species of *Byblis*.

Amongst the *Byblis liniflora* aff. "Darwin" at the Howard River location, I also discovered a *D. indica* -like plant that can only be described as a new species or at least subspecies of *D. indica*. The plants are extremely small when mature and flowering. The tallest specimen was no more than 5 cm which includes the erect flowering scape at the apex of the plant. The flowers are small, white and narrow petaled. I found this taxa at a number of locations especially when I came across *B. liniflora* aff. "Darwin." At one location I found a few specimens of this *D. indica* aff. "Darwin" that had pink coloured flowers. This taxa is common and forms large swarms over large areas of ground around the Howard River. This species is also quite at home in drier soils.

I found the typical *D. indica* at a number of locations but never growing with *D. indica* aff. "Darwin." The typical *D. indica* in the Darwin region is a large plant, golden green in colour with large pink flowers. First flowering plants are 15 cm in height. I saw specimens in the Darwin Herbarium of this plant that get to 60 cm tall later in the season. It appears the typical *D. indica* can get to rather large proportions if the growing conditions are favourable. The new taxa *D. indica* aff. "Darwin" on the other hand remains extremely small judging from older specimens of this species I later saw in the Darwin Herbarium.

Palmerston

A few kilometers south of Palmerston—the area is very hilly and covered with large *Eucalyptus* trees on the higher ground. The soil here is mainly laterite with patches of sand forming a thin covering over parts of the laterite. In the lower areas between the hills large meadow areas are formed which are the drainage areas from the surrounding hills. The soil here is a rich sandy-loam. It was in this drainage area that I first encountered *D. falconeri*. All the plants were deep-red in colour even when they were sheltered under other shrubs. *D. falconeri* forms a flat basal rosette of leaves up to 10 cm diameter at best although the majority of plants were about 6 cm in diameter. The lamina of this species is large, reniform-shaped and around 2 cm in width. No specimens were found in flower.

On the lower slopes of the laterite hills in a mixture of loose laterite gravel cemented together with a little sandy soil I found *D. petiolaris* aff. "Mini Rosette." This species formed flat basal rosettes of leaves up to 3 cm diameter at best. The old inflorescence arrangements were up to 15 cm in height. I know having cultivated this species that it has small white flowers no more than 1 cm in diameter and the scapes are covered in long silky hairs. Each rosette consisted of numerous leaves that were progressively getting shorter and gradually filling the centre of the plant. From the outside of the rosette to the centre, active lamina were present right to the middle of the plant. I could see by this growth habit that the plants were starting to shut-down for dormancy. Although the *D. falconeri* were still in active growth in the wetter soil not far away, the *D. petiolaris* aff. "Mini rosette" habitat was nearly bone-dry.

At one location in this immediate area I found a small number of hybrids between *D. falconeri* and *D. petiolaris* aff. "Mini rosette." This location was exactly where the two soil types met at the bottom of the laterite slope and at the very beginning of the lower drainage area. The hybrids were positioned in a thin line on the border of the two soil types. After a long search I found no hybrids on either side of this border. They only grew where the two soil types met and nowhere else. The hybrid *D. falconeri X D. petiolaris* aff. "Mini rosette" is a 50/50 mix of the two parents. The mature rosettes are 4 cm in diameter, with numerous leaves in a flat rosette and lamina reniform-shaped up to 1 cm wide. The entire plant is deep-red like *D. falconeri*.

On the gravel slopes but between the hills on down hill valley areas the soil is very much wetter for longer periods. It is here where the rain run-off gathers before moving down hill to the lower drainage areas where the *D. falconeri* grows. In these wet sloping valleys, another species is found, *D. petiolaris* aff. "Medium rosette." The soil type is similar to *D. petiolaris aff.* "Mini rosette", however there is a little loam mixed with the laterite and sand. It appears the loam being the smallest particle in size when compared with the laterite pebbles and sand grains travels the farthest distance down hill as the laterite hills are eroded away by the rains. A little loam gets caught in patches where the downhill slope flattens out a little. It is in this habitat that *D.petiolaris* aff. "Medium rosette" grows.

D.petiolaris aff. "'Medium rosette"' forms a flat basal rosette of leaves up to 5 cm in diameter. Many leaves are present in each rosette. The inflorescence is up to 40 cm in height and looks quite out of proportion when compared to the basal rosette Up to four extremely silky-hairy scapes are formed on the one plant. The flowers are pink in colour and 2.5 cm in diameter. The anthers provide a good character key with the addition of a strange, large hook-like projection above each anther. I have studied the majority of plants in the *D. petiolaris* complex from cultivated and pressed specimens and so far this species is the only one to have these strange hook-like projections at the apex of each anther.

Having revealed the possibilities of discovering more natural hybrids in the *D. petiolaris* complex, I went out of my way for the rest of the trip to check out areas where two soil types met to see if there were more hybrids to be found. I was to be pleasantly surprised at the end of my trip that my theory was correct and many different natural hybrids were found. I also discovered that of the many species in the *D. petiolaris* complex each species only grows in a particular soil type. If the two species are found in the one soil type then the division between the two species is one growing in the wetter ground. The other species in the drier ground.

Noonamah

This area can be best described as being a wet and a very wet area. The wet areas being a film of water just covering the soil surface and the wetter areas being flooded to the depth of 5 cm. The soil is mainly pure white sand grains in some areas in other areas mixed with humus to form black sand patches. Damp ground was also present where the soil formed ridges and hummocks just above the water table depth. This Noonamah area can best be described as CP heaven. In an area no larger than half a hectare, CP were in abundance. A good part of the day was spent botanising the region.

D. dilatato-petiolaris was growing everywhere but only on the hummocks and ridges above the main water table. In the wet areas both where a film of water was present and in the flooded regions numerous *D. petiolaris* plants were present. On the pure white sandy patches hybrids between *D. dilatato-petiolaris* and *D. petiolaris* were found. These were neat little plants, pure red in colour and half way in growth arrangement between the two parents. Each hybrid rosette was around 5 cm in diameter and formed a perfect semi-spherical ball of narrow leaves with every erect, semi-erect and horizontal leaf having dewy lamina present. Overall a beautiful plant. I have grown this hybrid in cultivation and this growth arrangement is maintained. The flowers are white and the scape is almost glabrous. The parents of the natural hybrid *D. petiolaris X D. dilatato-petiolaris* have dark pink and white flowers respectively.

In the drier areas a short distance away from the wet areas *D. burmannii* was common. This species formed small slightly scattered colonies. The majority of plants were green in colour due to shaded growing conditions but where the sunlight reached *D. burmannii* was a little reddish. In 1988 I found specimens of this species in full sun and every plant was maroon-red in colour. The flower colour on all of the Darwin species I found was white.

In the wet and flooded areas Utricularia were present by the hundreds. Along with *U. lasiocaulis, U. odorata, U. limosa, U. capillaris, U. hamiltonii, U. minutissima* and *U. chrysantha* which I had found at Howard Springs I also found the following:

U. leptoplectra—a tall species up to 60 cm in height with up to a dozen blue flowers having a distinctive 2-lobed lower lip and long narrow nectary spur. The lower lip is up to 2 cm in width. The entire outer surface of the flowers are dark-yellow in colour. I found one specimen that was pure white in colour on both the inner and outer petal surface. The plant was about half the size of the typical *U. leptoplectra* in the immediate area. The flower shape was similar to U. *leptoplectra* although the spur was a little shorter. I wondered at the time that I may have a hybrid between *U. leptoplectra* and *U. limosa* as *U. limosa* grew at the base of *U. leptoplectra* in this area where I found this suspect hybrid. I have this specimen in F.A.A. and further study may reveal the answers as to whether I have a hybrid or a weird form of *U. leptoplectra.* In 1988 I discovered a very nice population of *U. leptoplectra* near the Girrawheen Lagoon which had white colouring on the outer surface of the corolla in the place of the yellow coloring normally present.

U. holtzii—a short plant up to 3 cm tall with large cream to creamy-yellow flowers. The distinctive flowers have a deeply recessed 5-lobed lower lip and are around 1 cm in width. This species mainly grew in the wet and flooded areas. Each scape of this plant had individual flowers but many flowers were present in small close-knit colonies. I feel sure that a number of flowers are produced from the mass of leaves at the base which are the one plant.

U. kamienskii—a plant up to 10 cm tall with single white flowers. Each flower was about 1.5 cm in width with a 3-lobed lower lip. This species was common and grew in all the habitats and extended into slightly less wet soils. The bladder traps on this species are weird and the illustration of the traps in Peter Taylor's work is well worth checking out.

U. caerulea—a small plant in the area up to 8 cm in height with small white flowers and yellow palate. I also found this species in 1988 and thought at the time that it was *U. lateriflora*. According to Peter Taylor's work, *U. lateriflora* doesn't grow this far north. Using Peter Taylor's book proved that this species was *U. caerulea.* The main character key being the spurred bracts on the scape.

U. species—this may be *U. triflora* but further study is required. Plants to 8 cm in height with single mauve flowers and a slightly 3-lobed lower lip. I may have been early on this one and only saw single flowered specimens. *U. triflora* as the name suggests has three flowers. On first appearance my species looks like *U. hamiltonii* but on closer examination it is quite different.

Twelve species of *Utricularia* is quite a lot to handle in the one area. Even though I botanised the area to death, I believe visits throughout the year will produce more species in this same location. No one can claim this is all that grows there. I believe if I had this location on my door step here in Perth, I would turn up a lot more species than what I saw at this very small moment in time.

Also growing in abundance in this Noonamah area was *Byblis liniflora* aff. "Darwin". Many specimens were growing in the flooded areas and enjoying the conditions. This species likes wet feet. Also growing in the same conditions were juvenile plants of the typical large pink flowered *D. indica.*

The next area I wanted to look at was the approaches to and in the Kakadu National Park. I had a scientific permit to botanise the region within the park and to collect anything I came across that was new. As it turned out, Kakadu was bone dry and there wasn't much to be found anywhere. No collections were made in the Kakadu National Park. At the same time in 1988 when I was there, CP were to be found in abundance. It was a good wet year. 1990 however was a disaster as far as botanising was concerned.

All photos by and © by Allen Lowrie.

Drosera petiolaris. Darwin region. Matches the *D. petiolaris* TYPE collected on the Endeavour River Queensland on the Cook voyage.

Drosera petiolaris aff. "Kununurra". Species nova from N.E. of Western Australia.

Drosera petiolaris aff. "mini rosette". Species nova from the Darwin region.

Drosera petiolaris aff. "medium rosette". Species nova from the Darwin region.

My fortunes changed however on the approaches to Kakadu. Anywhere a river crossed the main road into the park, I had a good scout around. It was at these locations that I found the true *D. lanata* in abundance. These many leafed basal rosetted plants are covered in numerous dendritic hairs. That is hairs having a number of pointed spur-like projections branching off the main central pointed hair. The hairs are **translucent silvery-**white in colour. Dense masses of these hairs cover the leaves of the plant. Although the leaf is green in colour the mass of hairs give the overall effect of a silvery-grey coloured plant.

The lamina on *D. lanata* is maroon-red in colour and combined with the silvery-grey foliage presents a wonderful sight to the eye. This species was found growing only in white silica sand on high ground away from the main river and the wetter soil found there. I established that this species grew in soil that was only wet when it rained. There was no additional moisture to be gained from drainage from other areas. This species so to speak was a bit of an arid grower.

I wondered about the dense hairy covering and what its function may be. I knew that it would be a good insulation material when the plant was dormant. I have studied the pygmy *Drosera* of S.W. Australia for many years and established the fact that the silvery-white stipule bud on these species acts as insulation from the summer heat in the dormant period.

The answer came to me in a flash when I visited the *D. lanata* area on my way back to Darwin out of Kakadu. It was early in the morning and it hadn't rained for a week. As I set up to photograph these plants, I could see minute dew droplets on every hair through my camera lens. These small droplets were slowly running down to the base of each dendritic hair. Slowly but surely each one of these small droplets in turn joined with other droplets from other hairs. Finally the combined droplets formed a large water drop at the base of each leaf. As it became heavier this large water drop fell from the plant onto the soil surface near the base of the plant. Here the plant could take up the precious moisture through the roots.

Evolution has done a good job here in adapting *D. lanata* to its harsh growing conditions. However, *D. lanata* is not alone with this type self watering adaptation. I have read of plants, mainly very hairy cactus in the dry coastal regions of Chile, that capture their moisture on the hairs from fogs that cover them at times of the day. When the fog disappears the area is a harsh desert.

One of the main reasons for heading into Kakadu was to try and find specimens of *D. petiolaris* aff. "Erect". I had seen Herbarium specimens of this species in the Darwin Herbarium in 1988. These specimens were up to 35 cm in height. They came from the sandstone plateau in Kakadu. At the base of the sandstone I found this same plant but not growing tall as in the herbarium specimens. This species' growth arrangement was very similar to *D. petiolaris'*. That is, plants having erect and semi-erect leaves. I knew I had found the *D. petiolaris* aff. "Erect" plant as the leaves were extremely narrow and the petioles were covered in the same dendritic hairs as *D. lanata*! The specimens I found however were not erect like the Herbarium specimens but instead were forming a more pin-cushion effect low on the ground. Closer to Darwin many kilometers from Kakadu National Park, I found this species in abundance and in better growing conditions. The plants were a real sight. Many dewy lamina all crowded into a semi-spherical arrangement. Mature rosettes were up to 10 cm diameter and 10 cm in height.

Back in Darwin I went to the Herbarium and studied once again all of the sheets they had on this species. My field observations were correct. I had genuine specimens of *D.* petiolaris aff. "Erect". I spoke to Clyde Dunlop the collector of most of the specimens of this plant in the Herbarium and a few mysteries were cleared up on the spot. Clyde's specimens came from the sandstone escarpment from shallow pockets of soil. He remembered that the plants were growing up through spinifex bushes. These

plants were 35 cm tall because they were growing towards the light. They were also being supported by the spinifex bushes. Common sense told us that the plants could not grow 35 cm tall without being supported as they would fall over in the first wind. I was happy because I had solved the missing link in the known *D. petiolaris* complex.

A natural hybrid was found on this trip as well. It was the cross between *D. lanata* and *D. dilatato-petiolaris*. Although I didn't find a hybrid, I saw a patch of *D. petiolaris* aff. "Erect" growing near a patch of *D. petiolaris* aff. "Medium rosette" in Kakadu. I'm sure I could turn up a hybrid between these two in a good wet season.

Closer to Darwin near Humpty Doo I found *D. banksii* growing on the margins of a flood plain of a small creek. D. *banksii* was only growing in the red loam patches and not in the sandy soil which was the typical soil to be found there. Each plant was at best 8 cm in height and one or two were just coming into flower. I collected this species in 1988 and kept it growing for 18 months before it died. In the field the plants come up each year from seed. This species is not tuberous like *D.subtilis* another one of its kind from the Mitchell Plateau area in the N .W of Western Australia. Each plant of *D. banksii* has individual reniform-shaped leaves that are peltate near the upper margin. The petioles are terete and attached to the main erect stem at scattered locations. In plane-view the leaves are spread around the main stem in a circle. This species has fleshy white thread-like roots travelling a short distance down in the soil. Near the base of the plant further roots are present above the soil surface which in turn finally penetrate the soil. The flowers are white and 5 mm in diameter.

The final days of this leg of my journey were spent around Darwin. In that time I found:

U. muelleri growing in Girraween Lagoon. In amongst the water lilies and no doubt crocodiles, I couldn't resist the temptation to wade in and photograph and collect some specimens. This species is an aquatic *Utricularia* and produces a floating water-sheet arrangement of floats to support the inflorescence. The flowers are yellow. Also growing here was U. *australis* but they were not in flower.

U. *subulata* was found at one location near Girraween Lagoon well away from civilization so it didn't come from some CP collector's collection.

U. scandens was found on the road to Mandorah on a herb field meadow. This yellow flowered species twists its scape around near by herbs for support in the same fashion as *U. uolubilis* found in S.W. Western Australia.

D. dilatato-petiolaris growing in abundance around Palmerston. In one area in this region, I found along with *D. dilatato-petiolaris, D. petiolaris, D. petiolaris* aff. "Mini rosette", *D. petiolaris* aff. "Medium Rosette" and *D. falconeri.* I also found at least one example of a natural hybrid between every species combination of these five species.

On my last day in Darwin I spent some time in the Herbarium. As luck would have it the Herbarium boys had just returned from a helicopter collecting trip to the flood plains of the Finnis River. While the helicopter was hovering just off the ground two guys jumped out quickly (the water was shallow) while a third stood guard with a magnum revolver (crocodile watch). The two very quickly scooped up some water plants they were after and jumped back in the helicopter. The Finnis River is thick with crocodiles. Back at the Herbarium they placed their water plant collections into an aquarium. Much to their delight and mine they had also scooped up a heap of *Aldrovanda.* I managed to get some good photographs of the plants in the aquarium. Also they were good enough to give me a few specimens to take home with me.

The night of the 17th of April, I flew down to Kununurra in the N.E. of Western Australia about 500 km as the crow flies from Darwin.

The following day I want straight to the locations I had found in 1988. The season was pretty grim. Just like Kakadu they had not had a good wet season. The areas I was interested in however were still holding up and producing fairly good growing conditions for the CP's.

First on the agenda was D. petiolaris aff. "Kununurra". I had discovered this plant in 1988. I thought at the time that it was *D. lanata.* The more I studied the problem the more I had my doubts. Uncovering the real *D. lanata* in Darwin confirmed for all times that D. *petiolaris* aff. "Kununurra" is a new species. This species is covered with hairs just like *D. lanata* although not all of the hairs are dendritic. The petioles are broader and lanceolate in outline. The biggest plant I saw was 18 cm in diameter. The average size was 18 cm in diameter. Unlike *D. lanata, D. petiolaris* aff. "Kununurra" formed large clumps of plants of 40 cm in diameter. In my travels over the next few days I discovered this species is quite well spread, I found it in a 50 km radius of Kununurra township. Always growing at the base of spear grass in sandy soil.

At the same locations I also rediscoverd *Byblis liniflora* aff. "Kununurra" which I found on my 1988 trip. This species is robust. Plants up to 30 cm tall even in rather dry conditions. Multiflowered heads are normal on this species unlike the *Byblis liniflora* type. The flowers are large on this Kununurra plant. Each petal is pink on the surface and lemon-yellow on the outer surface. The apex of each petal is also serrated.

On my return to Perth I compared the seed of *B. liniflora, B. liniflora* aff. "Darwin" and *B. liniflora* aff. "Kununurra". In all cases the seed is quite different to each other. This fact plus many other differences leads me to the conclusion that we are dealing with two new species of *Byblis.*

The only other CP I found in Kununurra was *D. burmannii.* It was exactly the same plant as found in Darwin, as well as Sydney which I saw in 1987. The whole trip was a complete success and I got some very nice photographs from the 60 shots I took. I collected some great plants live and I have these in my collection now. There is a lifetime CP discovery in the northern regions of Australia and I intend to retum as soon as possible at the end of the next wet.

Special Notice

By Don Schnell

Dionaea is finally being proposed for Appendix II under CITES at the March, 1992 Conference of the Parties (8) in Kyoto, Japan. A similar proposition was written up tentatively for presentation at COP3 in 1981, but was withdrawn due to what was felt to be lack of sufficient information. Since then, mapping of locations, particularly in North Carolina where about 90% of the populations occur, has been undertaken and will be completed during 1991-1992. Also, there is documentation of the massive numbers of plants being removed literally by the dumptruck load, both legally and by poaching, but being passed for overseas shipment primarily to Europe via a few well-known nurseries in one country in particular. At least one of the companies has the gall to feature large color posters showing huge numbers of potted *Dionaea* on rack after rack in greenhouse, supposedly "propagated" but in reality grown from "bulbs" collected primarily by one contractor in North Carolina who employs others to help. Some of these commercial collectors have been caught in illegal activity as much as 20 times. The business is so lucrative when massive numbers of plants are collected (1.4 to 4.5 million per year) that the fines are shrugged off as business expense.

It is felt that Appendix II placement will discourage massive transfer of *Dionaea* out of country and encourage propagation activities. It is not clear what if any action will be taken by the US Fish and Wildlife Service under the Endangered Species Act [ESA] (if the Act is still with us next year!) and recommend to Congress in the Federal Register.

This author (DES) still subscribes to habitat destruction as being the main culprit in CP species depletion. However, there are clearly two limitations to this. One is where the species becomes so few in just a handful of locations (eg *Sarracenia oreophylla*) that even hobbyist collecting can have significant impact. The other situation is exemplified by *Dionaea* where habitat is decreasing at an alarming rate (only 5% of previous savanna habitats in the southeastern US still exist), and although the plants are easily seen in large numbers still, such massive collections year after year must certainly stress the remaining populations.

Comments from individuals are encouraged. In fact, as a CP enthusiast, you must consider it a duty. Writes Bruce MacBryde, Office of Scientific Authority, US Fish and Wildlife Service, Washington, DC 20240, USA. Bruce is a representative to CITES as well as being with F&W which administers the ESA.

Venus's Flytrap—Aphrodite's Mousetrap

(E. Charles Nelson and a postscript by Daniel L. McKinley. 1990. Boethius Press, Aberystwyth, Wales. 145 p.)

Book Review By Donald Schnell

This very worthwhile book is not about the Venus's Flytrap in the traditional botanical or natural history sense, but rather is an excellent history of the plant as recorded by western man from the early 1700's down to today, with heavy emphasis on early explorations and naming of the plant.

To get mundane but no less important details out of the way first, the book is very well produced technically with excellent boards, paper, clear printing, and a very sturdy paper jacket. On the jacket is a color reproduction of one of the earliest plates of *Dionaea* done by John Roberts. The plate is also the frontispiece, and we are told that it was usually done in black and white except for a few hand colored ones carefully doled out by John Ellis.

The first 52 pages or so of the book are written by E. Charles Nelson, taxonomist for the National Botanic Gardens at Glasnevin. Dr. Nelson is well known for his extremely detailed and painstaking research into botanical and taxonomic history in which appropriate names and/or authorities have been clarified or corrected. He is presently working on updating and correcting our *Sarracenia* and *Nepenthes* world lists along these lines as time allows. This early third or so of the book is a review of the history of *Dionaea* and includes many references, quotes and a few facsimile reproductions of early writings. The work is useful since many "actors" in the early years of the plant's discovery by colonists have been little mentioned before or mismentioned in other books presenting cursory summaries of *Dionaea*'s discovery. The appropriate roles of Governor Dobbs, Peter Collinson, the Bartrams, Daniel Solander, John Ellis, William Young, and so on are put into historical perspective.

For example, the Bartrams were not the first to successfully introduce live plants into England, nor was Governor Dobbs. The Bartrams sent herbarium material to Collinson and others, and Collinson had a particular passion for obtaining live material to the extent that his letters back to the colonies were often rude in demand. Not mentioned in other brief accounts is one William Young, nearly self-styled Queen's Botanist, who accompanied plants of *Dionaea* and many other North Carolina species personally back to England by boat. As some may know, live plant transport in those

days was a dubious proposition, to say the least. Sailing ships were at the mercy of winds and weather. A passage over a particular stretch of water that in fair weather might take weeks, in poor weather might take months of cross-sailing and riding out storms. indifferent captains had other problems on their minds than the salt-sprayed plants on deck, or those molding in the hold. Even seeds had to be imbedded in a thick layer of beeswax to protect them.

But Young was fortunate and he paid for his American expenses and voyage by selling most of the Carolinan plants to a prominent London nurseryman for a considerable sum, selling a few individual Venus's Flytrap plants to others with interest. All were fascinated by the species, but no one knew how to grow it, and while the plants of this first shipment lasted a while, they probably all died off in a few years. But by then many more transports were being made, and the French in particular had better luck growing the plant.

Interestingly, the official publication of the species was legitimately accomplished (even by modern ICBN rules pertaining back to that day) in 1768 by Ellis in a descriptive letter to a London newspaper! The actual name for the plant was probably verbally suggested by Solander, but he was busy preparing for the first voyage with Banks and Cook, so Ellis followed through and is the proper authority.

The middle third of the book is a facsimile reproduction of a 1770 pamphlet written by Ellis, the main intent of which was to inform exporters on how to get various plants and seed safely to the American Colonies for agricultural purposes. To this was appended a more appropriate description of *Dionaea* along Linnaein lines of the day (flowers being extremely important). This is fun to read once one gets use to the old English custom of using the f-like symbol for "s" in the middles of words.

The final main portion of the book is a long, extremely valuable and interesting contribution by Daniel McKinley, an emeritus professor with a great interest in historical botany in this country. His task was to search out the source for the commonly used name "Tipitiwitchet" for *Dionaea* as a sort of common name in the mid and late 1700's. It has been most often attributed to American Indians, as Ellis even tried to say, but Dr. McKinley makes sort work of this. His search stands as a model of research into this sort of thing, and using many references hard to get and not taken up for years, he is able to piece together a rather amazing story on the origin of the word that is quite credible. I will not spoil things for readers by giving the solution here, but I will say that Dr. McKinley shows that the pre-victorian "gentleman botanists" were a rather bawdy lot with certain non-botanical fixations, amusingly even the Quaker Bartrams and Colllnson. Indeed, when the very prim and proper Darlington in 19th century America did a biography of the Bartrams, the probably key letter between them and Collinson explaining the origin, or at least hinting at it, of "tipitiwitchet" came up missing after that and McKinley could not find it.

Of even more interest is what we might term "the great coverup" (my term). In order to sanitize for public consumption the connotation "tipitiwitchet" was classicized to *Dionaea*. Dr. McKinley also explains, the goddesses Venus and Dione were not at all altruistically perceived by our pre-Victorians.

I hope I have whetted your appetite because this is truly an excellent book of botanical history covering our *Dionaea*, which you will not look at the same way again after reading! It is a lot of fun and very informative in its engaging writing style. The book is well annotated and a complete bibliography included. By the way, Dr. McKinley's essay almost missed out. The book was in final proof and ready to be printed when Dr. Nelson received the unsolicited McKinley manuscript in the mail. He insisted on its inclusion in spite of causing delays, and rightly so.

Literature Review

By Don Schnell

Cresswell, J. E. 1991. Capture rates and composition of insect prey of the pitcher plant *Sarracenia purpurea*. Am. Midl. Nat. 125:1-9.

In a sphagnum kettle bog of southern lower Michigan, the author studied prey capture by *S. purpurea* by monitoring prey every few days in 214 pitchers for a total of 55 days. During that time there was a total of 504 prey individuals from 49 families and 13 orders, 71% being *Diptera*. Interestingly, 50 % of the pitchers caught nothing and 66% of the total biomass was found in 8% of the pitchers. Some of the pitchers were periodically obstructed by spider webs which may have been a factor in decreased capture. Prior to studying any pitchers in a quadrat, the pitchers were washed of any accumulated prey, partially plugged with cotton in their depths to prevent prey from disappearing from sight in the acute curve at the base of the pitcher, and fluid was replaced with distilled water.

(Ed. Note: This study has several problems. First, it was not begun until 15 August of the study year season! In Michigan, this is nearing the end of prime pitcher capture activity. An earlier season start with inclusion of young pitchers (and indeed, comparing aged with new spring pitchers) might have been more useful. Also, it would be more helpful to relate the 214 pitchers to actual numbers of plants so that one might estimate what each plant was doing. Finally, one might seriously question the cotton plugging/distilled water manipulation of pitchers, especially if they were inspected only every 5 days. There are several other problems, but these are some of the primary ones.)

Determann, Ron. 1991. Rescuing endangered species. Clippings (Atlanta Botanical Garden members' newsletter) 14:1,6.

Readers will recall a recent review in CPN on the efforts of Ron Determann, the Atlanta Botanical Garden and Georgia officials to conserve botanical areas, and importantly, a plan for species recovery. The main thrust for this is Ron who is the Superintendent of the Fuqua Conservatory at the Garden and a CP enthusiast. As a comparative example of inaction vs. action, the US Fish and Wildlife Service has for about fifteen years been trying to come up with a recovery plan for *Sarracenia oreophylla*. To date, nothing practical has emerged, and indeed "conserved" sites continue to mostly deteriorate, although there are plenty of quadrat count markers! In about three years, the group in Georgia has come up with its own recovery plans, and they are already in action.

The cover of the newsletter (page 1) features fine black and white photos of *Sarracenia purpurea ssp. venosa* (occurs in very few locations in northeast Georgia—American CP enthusiasts will recall the "Georgia break" in the species range maps), seedlings of *S. oreophylla* (recently found in extreme northeast Georgia and immediately adjacent North Carolina), and plants of a *S. rubra* (probably ssp. *gulfensis*) recently found along the fall line in Georgia just south of Macon. The interior text page describes what is being done with each of these species. *S. oreophylla* has been increased to 1000 plants in pots and the plan is to introduce these into protected sites. *S. purpurea* is ready for expansion of recently reclaimed sites. *S. rubra* is rare in the new location, there being as few as four plants in one location. In October, 400 one year old seedlings (the plant grows very rapidly in cultivation) were planted in one location with full cooperation of the landowner, which will help with security.

Gibson, T. C. 1991. Differential escape of insects from carnivorous plant traps. Am. Midl. Nat. 125:55-62.

This paper was derived from some of the author's PhD candidate research in 1975

and compiled in his doctoral dissertation of 1983. In a hillside seep near Crestview, Florida, insect capture and escape were noted particularly in *Pinguicula lutea* and *Drosera filiformis* var. *tracyi*, although some other species are mentioned peripherally. Observations and statistical analysis and presentation indicate that body size thresholds were 5 mm and 10 mm respectively before escapes were usual. From these data, the author proposes that there is a positive evolutionary pressure for ever larger trap species in order to retain larger prey from the environment, resulting in a CP environment in larger, multiple species CP bogs (e.g. Gulf coast) that is quite diverse.

(Ed. note: At one point the author postulates or implies that *Dionaea* with its strong, active trap may have evolved and adapted due to its ability to capture larger prey. Noting the threshold size of about 1 cm for *D. filiformis* var. *tracyi*, those of us experienced in growing and observing *Dionaea* know that prey that approaches 1 cm, let alone larger, most often results in death of the trap leaf before absorption could take place, hardly an adaptive competitive feature there. One other point: The author implies a persistent assumption here (stated overtly in his original dissertation) that there is prey selection stress in a CP bog and that different pitcher and other trap morphologies are a good mix to take advantage of the entire insect buffet, as it were, that is present. But there is no attempt to enumerate [with controls!] and analyze the potential prey fauna abroad to see if there is truly a fall in various prey numbers that might stress plants through decreased capture ratios; and seasonality of new pitchers, insect populations, etc., are not well accounted for.

Prankevicius, A. B. and D. M. Cameron. 1989. Free-living dinitrogen-fixing bacteria in the leaf of the northern pitcher plant (*Sarracenia purpurea* L.). Naturaliste Can. 116:245-249.

In a bog of *S. purpurea* in Ontario, the researchers cultured the contents of pitchers from several plants and among other organisms were able to isolate three bacterial species capable of dinitrogen fixation. The authors postulate this as another source of nitrogen compounds captured from elemental nitrogen in the atmosphere, as it were. As a control, they also cultured air samples and the very low level of the same organisms indicated more than passive inoculation in the pitcher leaves. ((Ed. Note: It might have been helpful if they had also cultured the bog soil/moss, and possibly leaf surfaces of other non-CP plants.)

The 1991 List Of CP Books

Not available through CPN. Order directly from publisher, your local bookshop or C.P. Nursery.

☆ = Books intended primarily for children.
❑ = Books out-of-print.

☆❑ 1. Animals & Plants that Trap by Phillip Goldstein. Holiday, 1974; Holiday House, Inc.: 18 E. 53rd St.; New York, NY 10022. $5.95.

2. Carnivorous Plants by Gordon Cheers. Globe Press. Melbourne. (ISBN 0-9591937-0-7) International Spec. Books. See #9 for address. $9.95

3. Carnivorous Plants by Francis E. Lloyd. Peter Smith; 6 Lexington Ave., Magnolia, MA 01930; USA. 1942 ed. Paper $7.95. (ISBN 0-486-23321-9)

4. Carnivorous Plants by Randall Schwartz. Avon Books, 1975; 959 Eighth Ave.; New York, NY 10019; USA. Soft cover $1.25 (ISBN 0-275-51580-X)

5. Carnivorous Plants by Adrian Slack. MIT Press, 1979; 28 Carleton St.; Cambridge, MA 02142; USA. 1980 ed. $28.00. 1984 paper $12.50. (ISBN 0-262-69089-6)

❑ 6. Carnivorous Plants by John F. Waters. Franklin Watt, Inc., 1974; 845 Third Ave.; New York, NY 10022; USA. $4.90.

☆ 7. Carnivorous Plants by Cynthia Overbeck. Lerner Publications, 1982; 241 First Ave.; Minneapolis, MN 55401; USA. Paperback $5.95. (ISBN 0-8225-9535-4)

8. Carnivorous Plants by Paul Temple. 1988. A Wisley Handbook. Royal Horticultural Society, London. Available in US for $5.95 from Sterling Publishing Co., 387 Park Ave. S.; New York NY 10016-8810. (ISBN 0-304-30045-6)

9. Carnivorous Plants of Australia. Vol. I & II by Allen Lowrie. West Australia Univ. Press, 1986; Nedlands, WA 60009; AUSTRALIA. Or: International Specialized Books; 5602 NE Hassalo St.; Portland, OR 97213; USA. 800/547-7743. Paperback $32.50; hardback $45.00. Plus $2.25 UPS. (ISBN 0-85564-254-8)

10. Carnivorous Plants of California by J. Hawkeye Rondeau, PhD. 1991. $15.95 +postage from author (37 Sunnyslope Avenue, San Jose CA95127; USA. Tel. 408/929-6529.)

10. Carnivorous Plants of the World by J. & P. Pietropaolo. Timber, 1986. Peter Pauls Nurseries; Canandaigua, NY 14424; USA. $30.30.

❑ 11. Common Marsh, Underwater & Floating Leaved Plants of the United States & Canada by Neil Hotchkiss. 1972.

12. CP of the US & Canada by D. E. Schnell. John F. Blair, Publisher, 1976. 1406 Plaza Dr., SW; Winston-Salem, NC 27103. 1976 ed. $9.50 + shipping. (ISBN 0-910244-90-1)

❑ 13. Cultivating Carnivorous Plants by Allen Swenson. Doubleday & Co., 1977; Garden City, NY 11535; USA. $7.95. (ISBN 0-385-11148-7)

☆❑ 14. Insect-Eating Plants by L. & G. Poole, T.Y. Crowell, 1963; 666 Fifth Ave.; New York, NY 10016; USA. $4.50

15. Insect-Eating Plants and How to Grow Them by Adrian Slack. 1986. (ISBN 0-295-96637-8). Marston Exotics; Brampton Lane, Madley, Hereford; ENGLAND UK HR2 9LX. £13.50 ($22.55 aprox.) includes postage & handling (P&H).

16. Insectivorous Plants by Charles Darwin. AMS Press, 1893; 56 E. 13th St.; New York, NY 10003; USA; Vol. 12, 1972. $42.50. (ISBN 0-404-08412-5)

17. *Nepenthes* of Mt. Kinabalu (in English) by S. Kurata. Sabah National Park. Marston Exotics (see #15 for address). £7.50 ($12.53 approx.) includes P&H.

❑ 18. Pitcher Plants by Carol Lerner. William Morrow & Co.; New York. $12.95. (ISBN 0-688-01717-7)

❑ 19. Pitcher Plants of Peninsular Malaysia & Singapore by Roger G. Shivas. $10.50. (ISBN 9971-954-16-8)

20. Plants of Prey in Australia by Rica Erickson. Univ. of W. A. Press, 1986. Marston Exotics (see #15 for address). £16.75 ($27.97 approx.) includes P&H.

☆❑ 21. Plants That Eat Animals by J. H. Prince. Lodestar Bks.; 2 Park Ave.; New York, NY 10016; USA; 1979 ed. $8.95.

22. The Carnivorous Plants by B. E. Juniper, R. J. Robins and D. M. Joel. Academic Press, Book Market Dept., 1250 Sixth Ave., San Diego, CA 92101. Tel. 1-314-528-8110. $150.00. (ISBN 0-12-392170-8)

23. The Genus *Utricularia*, a taxonomic monograph, KEW Bulletin, Series XIV, Royal Botanical Gardens. $68.00. (ISBN 0-11-250046-3) HMSO Publication Center, P.O. Box 276, London SW8 5DT, ENGLAND.

This is a list of a CP book and magazine articles written in the French language

Book

Pierre Jolivet, Les Plantes Carnivores. (Science et Decouvertes Collection. Editions du Rocher, Paris, 1987), 126 pages. ISBN 2-268-00595-X

Magazine Articles

1. Pierre Jolivet, "Insectes et Plantes Carnivores," Le Courrier de La Nature, Vol 116: 22-28. 1988
2. Pierre Jolivet, "Insectes et Plantes Carnivores," Le Courrier de la Nature, Vol 117: 20-24. 1988.
3. Pierre Jolivet, "A la Recherche du Monde Perdu," Le Courrier de la Nature, Vol 124: 32-35. 1990
4. Pierre Jolivet, "A la Recherche du Monde Perdu," Le Courrier de la Nature, Vol 125: 28-32. 1990

Index Volume 20 (1991)
Article index

A Field Trip to Darwin and Kununurra for CP 114
A Revised World List of the Genus *Genlisea* St. Hil. 59
A Special Issue Dedication-to Peter Taylor 5
A Weekend at the Bruce Peninsula 99
Back to Caraça 110
Book Review-Venus's Flytrap-Aphrodite's Mousetrap 124
Carnivorous Plants of Caraça (Brazil), South America 79
CP Articles and Book in French 129
CP Without a Greenhouse 98
Culturing *Drosera petiolaris* aff. "Kununurra" 72
Editor's Corner 3
Editor's Corner-A Word About CPN Production 63
First Verified Reported Case of Sporotrichosis in an ICPS Member 69
Literature Review 83
News & Views 64
Notes on Distribution of North American *Utricularia* 14
Peter Taylor-A Short & Informal Biographical Sketch 6
Pinguicula villosa The Northern Butterwort 73
Pinguicula vulgaris Along the Early Alaska Pipeline 78
Plant Versus Animus 70
Special Notice re. Dionaea 123
Special Notice re. Plant Names 82
The 1991 CP Sources 89
The 1991 List of CP Books 126
The Genus *Genlisea* 20
The Genus *Genlisea* St. Hil.-An Annoted Bibliography 27
Utricularia in North American North of Mexico 8
What is the Identity of the West Gulf Coast Pitcher Plant, *Sarracenia alata* Wood? 102
World List of Genus Utricularia (Revised) 45